

CHANGE OF NAMES.

Mr. C. P. Alexander has recently called my attention to the fact that some of the names that I used in describing certain *Tipula* in my article in Jour. N. Y. Ent. Soc. Vol. IX No. 3 (1901), were preoccupied. Some of these I had noted before but had neglected to change them. I now wish to propose the following changes:

Page 107, for *Tipula clara* substitute *T. pellucida*.

Page 115, for *Tipula concinna* substitute *T. olympia*.

Page 119, for *Tipula albovittata* substitute *T. vittatipennis*.

Page 121, for *Tipula contaminata* substitute *T. commiscibilis*.

Page 124, for *Tipula graphica* substitute *T. fulvilineata*.

A PROBLEM IN THE FLIGHT OF INSECTS.

HERBERT OSBORN.

In the usual explanations for the flight of insects, the mechanism is considered essentially as a plane with a rigid anterior border, flexible hinder border and with a vertical movement so that the vibrations result in the forward propulsion of the insect and, so far as I am aware, no further discussion of the modes of progression have been presented. There is, however, another feature in the flight of insects which appears to me to be well worthy of notice and which is not explained by the application of these principles, at least without some modification. Insects, aside from the direct forward flight, are able to hover or even fly distinctly backward as of course everybody who has observed insects must have noticed. It is only necessary to recall the hovering flight of swarms of insects in the air, such as midges, gnats, certain species of flies, May-flies, and even grasshoppers, to appreciate the distinctness of this feature of flight. For a distinctly backward progression, we may cite the approach and retreat of the hawk moths in their visits to flowers, the backward and forward movements of bees as they light or rest upon plants, the dragon-flies, and perhaps especially the backward flight of the honey bee in its initial flight from the hive when it is fixing the location of the entrance to its hive.

Now if we consider the mechanism of the wing as simply a membrane with a rigid anterior border and the progression

effected by the up and down movement of this membrane, the propulsion being determined by the flexibility of the posterior border, it will be seen that while this device provides beautifully for the forward progression of the insect, it does not account for such backward movements as have been noticed. This problem has been in mind for several years and I have presented it on a number of occasions to my classes in Entomology and it has provoked a good deal of discussion, and it appears to me that it is possible to offer an explanation which may be considered somewhat of a solution of the problem. This solution has been suggested and contributed to by a number of students in these discussions and it may be difficult to credit the explanation to any original source.

The explanation of these movements seems most readily accounted for on the basis of an adaptation in the wing which provides for a forward and backward movement so that the angle of the wing with reference to the axis of the body represents different degrees ranging from a right angle to an angle of 30 to 45 degrees for the anterior quadrant. It will be seen that when rotating forward in this manner, the rigid portion of the anterior part of the wing is shifted so that the flexible apical and posterior margins have a different extent and must present a varying pressure upon the air. It appears quite certain that this rotation would allow for varying degrees of the forward and backward pressure, or to state it in another way that the direction of force of each wing would form an angle to the median axis of the body, and that at the point where these would neutralize each other, the effect would be to produce a stationary condition of the insect whereby it would hover at a fixed point, and that a slight further rotation forward would serve to push the insect in a backward direction.

That this mechanism actually exists in many insects may be determined by the movement of the wing forward or backward in a horizontal plane, and it is easily noted in the position in which wings are fixed at death in many insects. Comparison among different groups of insects will show that the extent of rotation differs greatly in different groups and this would agree thoroughly with the fact that the ability to hover or to retreat in flight is very differently developed in different insects. Furthermore, it appears that the ability for this kind of flight depends in some degree upon the shape and especially upon

the width of the wings, as it will readily be recalled that the broad winged moths and butterflies show little if any flight of this character, whereas the narrow winged hawk moths, flies, bees, etc., which have the property distinctly developed are mostly narrow winged species. Furthermore, it seems that the development of lobes or other variable extensions of the membrane on the posterior border may be significant in this connection. An exhaustive comparison amongst different species of insects, and careful reference as to the extent to which hovering or backward flight is possessed by the different species would be an interesting matter in this connection, but the author has not had time to devote to such a research and the problem is presented here rather as a suggestion for investigation than with the idea that it has been exhausted.

FAUNISTIC STUDIES IN ENTOMOLOGY.

HERBERT OSBORN.

I desire to call attention in this note to the desirability of more extensive and especially more distinctly correlated studies upon the insect fauna of the country and especially with reference to the localities represented by the members of this society.

There is no question, I think, as to the great desirability of studies on the geographical distribution of insects, but I have been particularly impressed with the necessity for such studies and the desirability that it should be pushed to greater intensity by recent efforts to secure data concerning the distribution of the species in a group upon which I have been engaged.

The records of occurrences for insects have always been a quite prominent feature of entomological journals and to a considerable extent, lists of species in certain groups, for certain localities, states, or districts, have appeared in various journals. While the preparation of such lists may by some be considered as a rather easy part of entomological investigations, it appears to me that accurately done work of this kind becomes of the highest scientific value, and that we may very well encourage it to the greatest extent that is possible. Undoubtedly this particular kind of work is one which could be entered upon with the greatest interest and with promise of most distinct